

**WEST VIRGINIA DEPARTMENT OF TRANSPORTATION**  
**DIVISION OF HIGHWAYS**  
**SPECIAL PROVISION**  
**FOR**

**STATE PROJECT:** \_\_\_\_\_

**FEDERAL PROJECT:** \_\_\_\_\_

**SECTION 679**  
**OVERLAYING OF PORTLAND CEMENT CONCRETE**  
**BRIDGE DECKS**

**679.1 - DESCRIPTION:**

The work shall consist of furnishing and placing a specialized concrete overlay to a designated grade line. Unless otherwise indicated on the plans, the Contractor may place any one of the specialized overlays allowed by the terms of this specification. Only one type of overlay will be allowed on any one structure.

**679.1.1 - Other Work:** The following work, as required by the contract plans, may also be performed under the terms of this section:

- a) Clean the bridge deck
- b) Bridge deck repair
- c) Clean exposed reinforcing steel
- d) Support and tie reinforcing steel
- e) Place slab reconstruction concrete
- f) Abutment backwalls and approach slabs repair (same as bridge deck or as shown in the plans.)
- g) Hydrodemolition of existing deck surface

**679.1.2 – Definitions:**

**679.1.2.1 - Specialized Concrete Overlay:** Two types of specialized concrete overlay are permitted as follows:

- 1) **Latex Modified Concrete:** A portland cement concrete to which an approved styrene butadiene latex admixture has been added.
- 2) **Microsilica Concrete:** A portland cement concrete to which an approved Microsilica admixture has been added.

**679.1.2.2 - Slab Reconstruction Concrete:** Slab reconstruction concrete is that concrete placed completely around exposed reinforcing bars.

**679.1.2.3 - Curing Hour:** A curing hour is any hour, beginning with the hour of placement, during which the ambient air temperature at the concrete surface remains at, or above, 45° F (7° C) as measured by a recording thermometer.

**679.1.2.4 - Curing Temperature:** This is the air temperature at the concrete surface, or the air temperature between the concrete surface and its protective covering.

## **679.2 – MATERIALS:**

**679.2.1 – General:** Materials used in the manufacture of specialized concrete overlays shall meet the requirements specified in Section 601.2 of the Specifications and as required herein.

**679.2.1.1 - Fine Aggregate:** Fine aggregate shall be silica sand meeting the requirements of Sections 702.1.2 through 702.1.5 and 702.6 of the Specifications.

**679.2.1.2 - Coarse Aggregate:** Coarse aggregate shall be AASHTO Size No. 8 crushed stone or gravel conforming to Section 703 of the Specifications.

**679.2.1.3 – Latex Admixture:** Formulated latex modifier shall meet the requirements of Section 707.5 of the Standard Specifications.

**679.2.1.4 – Microsilica Admixture:** Microsilica Admixture shall meet the requirements of Section 707.4.3 of the Standard Specifications.

**679.2.1.5 - Bonding Grout:** Bonding Grout shall consist of the actual modified concrete being used, with the coarse aggregates removed, mixed with sufficient water to form a slurry. The consistency of the slurry shall be such that it can be applied to the prepared concrete surfaces with a stiff bristle broom in a thin, even coating that will not run or puddle. The bonding grout shall be applied using a stiff broom and worked into all areas of the slab.

**679.2.1.6 - Class K Concrete:** Class K Concrete shall meet the requirements of Section 601 of the Specifications except that coarse aggregate shall meet the requirements of 679.2.1.2.

### **679.2.1.7 - Curing Materials:**

**Burlap:** This shall meet the requirements of Section 707.7 of the Specifications.

**Quilted Covers:** These shall be clean and free of defects, providing a water retention blanket over the concrete. Acceptance will be based on visual inspection.

**Polyethylene Curing Covers:** These shall meet the requirements of Section 707.6 of the Specifications.

**Plastic Coated Fiber Blankets:** These shall be clean and free of defects, providing a water retention blanket over the concrete. Acceptance will be based on visual inspection.

**679.2.1.8 - Replacement Bars:** Reinforcing bars shall be Grade 60 and shall meet the material requirements of Section 602 of the Specifications. Replacement bars shall be spliced to existing bars using either minimum 30-bar diameter lap splices or approved mechanical connectors.

**679.2.2 - Specialized Concrete Mix Design and Testing:** Specialized concrete shall consist of a homogeneous mixture of cement, fine aggregate, coarse aggregate, latex or microsilica admixture, chemical admixtures and water.

The Contractor shall determine mixture proportions in general accordance with ACI 211.1, "Standard Practice for Selecting Proportions for Normal, Heavyweight and Mass Concrete." Establishment of mixture proportions shall be coordinated with the manufacturer of the latex or microsilica admixture.

Design mixture testing shall include air content, slump, and compressive strength results at 28 days and results of rapid chloride permeability tests. For establishment of mixture proportions, rapid chloride permeability tests shall be made on representative samples cured for 28 days in accordance with ASTM C31, then prepared and tested in accordance with AASHTO T277 at an age of 35 to 42 days. The results of this test should not exceed 750 coulombs.

The 28-day compressive strength of the test mix that satisfies the 750 coulomb threshold, shall be used as the basis for acceptance of the Specialized Concrete Overlay permeability requirements. Concrete for any slump test shall be deposited in a manner and location that excludes the effects of vibrations caused by traffic and concrete placement operations.

The total concrete constituents shall contribute less than 0.10% water soluble chloride ion by weight of cement. Use one brand and/or one source for any concrete constituent.

The Contractor shall obtain a written statement from the manufacturer of the latex or microsilica admixture that confirms the compatibility of the material combination and the sequence in which they are combined. The written statement, along with the results of all required tests, shall be furnished to the Engineer prior to the pre-construction meeting (refer to 2.2.3). Substantiating data showing compliance with the requirements of this specification shall also be submitted. This data shall also include the sources of coarse and fine aggregates as well as the brands of all admixtures to be used.

**679.2.2.1 - Latex Modified Concrete:** The following test criteria must be met for all latex modified concrete pours placed at the structure. This testing shall be performed by the Contractor or his designated representative and certified results provided to the Engineer prior to final acceptance of the project.

Chloride Permeability (a)	1000 coulombs @ 90 days, maximum (per AASHTO T277)
Compressive Strength,(b)	not less than 80% of 28-day compressive strength of the approved test mix
Water/(Cement + fly ash) Ratio (c)	0.40 by weight, maximum
Portland Cement Content (d)	658 lb/cu. yd., minimum (390 kg/m <sup>3</sup> , minimum)
Latex Admixture Content (e)	24.5 gal/cu. yd., minimum (121 liters/m <sup>3</sup> , minimum)
Air Content (f)	6.5% maximum (Per AASHTO T152)
Slump	4.0 inches ± 2.0 inches (100 mm ± 50 mm)
High Range Water Reducer(Superplasticizers)(g)	As needed for workability, slump and water/cementitious ratios

- Note (a) Chloride permeability test shall be performed and the results tabulated and submitted to the Engineer. These results will not be used for acceptance provided the compressive strength requirements are satisfied.
- Note (b) The minimum compressive strength for the overlay concrete shall be 80% of the 28-day compressive strength of the approved test mix. However, the minimum 28-day compressive strength shall be 4,000 psi (28 Mpa). Overlay concrete with a compressive strength of less than this acceptance level may be removed and replaced at the contractor's expense.
- Note (c) The amount of added water shall be adjusted to provide slump at or below the prescribed limit. The water portion of all admixtures shall be included as part of the water/cement ratio.
- Note (d) An equal volume of fly ash may be substituted for cement to a maximum of 1 ¼ bags per cubic yard (meter). When fly ash is used, equivalent volumes of fly ash shall be considered as cement for purposes of determining the proportioning ratios.
- Note (e) Latex sampling shall be in accordance with 707.5.
- Note (f) The initial mix design shall be based on an expected air content range of 3% to 6%. The mixture proportions shall be determined using actual conditions for fineness modulus and bulk specific gravities (saturated surface dry for aggregates).
- Note (g) A high range water-reducing admixture is required to improve workability. No more than two additions of the admixture shall be made, and the total quantity shall not exceed the manufacturer's maximum dosage rate. Each time high range water reducer is added, the concrete shall be mixed an additional minimum of 30 revolutions. The total number of revolutions shall not exceed 300.

**679.2.2.2 - Microsilica Concrete:** The following test criteria must be met for all microsilica concrete pours placed at the structure. This testing shall be performed by the Contractor or his designated representative and certified results provided to the Engineer prior to final acceptance of the project.

Chloride Permeability (a)	1000 coulombs @ 90 days, maximum (per AASHTO T277)
Compressive Strength,(b)	not less than 80% of 28-day compressive strength of the approved test mix
Water/(Cement + microsilica + fly ash) Ratio (c)	0.37 by weight, maximum
Portland Cement Content (d)	680 lb/cu.yd., minimum (404 kg/m <sup>3</sup> , minimum)
Microsilica Content (e) (Dry Weight)	50 lb./cu. Yd., minimum (30 kg/m <sup>3</sup> , minimum)
Air Content	7.0% (plus or minus 1.5%) (Per AASHTO T152)
Slump	6.5 inches ± 1.5 inches (165 mm ± 40 mm)
High Range Water Reducer(Superplasticizers) (f)	As needed for workability, slump and water/cementitious ratios

- Note (a) Chloride permeability test shall be performed and the results tabulated and submitted to the Engineer. These results will not be used for acceptance provided the compressive strength requirements are satisfied.
- Note (b) The minimum compressive strength for the overlay concrete shall be 80% of the 28-day compressive strength of the approved test mix. However, the minimum 28-day compressive strength shall be 4,000 psi (28 Mpa). Overlay concrete with a compressive strength of less than this acceptance level may be removed and replaced at the contractor's expense.
- Note (c) The amount of added water shall be adjusted to provide slump at or below the prescribed limit. The water portion of all admixtures shall be included as part of the water/cement ratio.
- Note (d) An equal volume of fly ash may be substituted for cement to a maximum of 1 ¼ bags per cubic yard. When fly ash is used, equivalent volumes of fly ash shall be considered as cement for purposes of determining the proportioning ratios.
- Note (e) Microsilica sampling shall be in accordance with 707.4.3.
- Note (f) A high range water-reducing admixture is required to improve workability. No more than two additions of the admixture shall be made, and the total quantity shall not exceed the manufacturer's maximum dosage rate. Each time high range water reducer is added, the concrete shall be mixed an additional minimum of 30 revolutions. The total number of revolutions shall not exceed 300.

**679.2.2.3 - Pre-Pour Meeting:** The Contractor shall schedule a meeting prior to the start of the concrete work. The Engineer, Construction Manager, Prime Contractor, Concrete Contractor, Concrete Finisher, and the Concrete Supplier shall attend. Topics of discussion shall include specialized concrete mixture proportions, batching, transporting, handling, placing, finishing and curing.

**679.2.2.4 - Test Slab Requirements:** After obtaining the Engineer's approval of mixture proportions and at least one week before any slab reconstruction concreting or overlay is to be placed, the Contractor shall make one or more trial batches of the specialized concrete of the size to be hauled or mixed at the site. The trial shall simulate transportation and job site conditions, utilizing proposed material and methods of placing, finishing and curing. The test slab shall be constructed the same as the actual work (depth, reinforcing steel, etc.) and shall be at least one lane width wide and of a length to allow the use of the contractor's entire paving train from placement to finishing. The test slab location shall be as shown in the plans or as approved by the Engineer. The prime intent is to familiarize the concrete finishing crew with the handling, finishing and curing characteristics of the concrete. Batching, placement and texturing shall be in strict accordance with this specification. Additional reference test slabs may be constructed as necessary to provide an acceptable standard of reference. This standard of reference shall serve throughout the project construction period as the basis of acceptance of the actual as-built work. This Item may be deleted at the discretion of the Engineer.

**679.2.3 – Equipment:** All equipment proposed for use shall have the Engineer's approval prior to its usage.

**679.2.3.1- Cutting Equipment:** Shall consist of a high pressure water jet (hydrodemolishing) system per the following requirements.

**679.2.3.1.1 – Hydrodemolishing Equipment:** The hydrodemolishing system shall be self-propelled, completely programmable, designed for high production concrete removal, and capable of removing precise depths of sound concrete. Hydrodemolishers shall be capable of removing concrete from around and below the steel reinforcement. Lances shall be of a type intended to remove rather than scarify concrete. Individuals certified by the equipment manufacturers shall operate the removal equipment.

All removal equipment shall be capable of operating at a noise level of less than 90 decibels at a distance of 50 feet (15 m) from the noise source. The Contractor shall monitor noise levels throughout the project to insure compliance, if required by the Engineer. No separate or additional payment will be made for monitoring -noise levels.

Potable or filtered water may be used. Filtered water shall have all visible solids and oils removed that could prevent a. proper bonding with the remaining concrete. When filtered water is used, the Contractor shall wash the bridge deck with potable water in water blasting equipment as soon as all the concrete debris have been cleaned up. This water blasting shall be in addition to any other water blasting that may be required by any other special provisions.

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The Contractor shall shield his operations to prevent injury or damage from flying or falling debris. The Contractor shall provide a method for handling expected and unexpected blow-through of the deck. This method shall provide for the containment of runoff water and debris, and the protection of the area under the bridge deck. The Contractor shall be responsible for any injury or damage caused by his operations.

**679.2.3.1.2 - Hydrodemolishing Equipment Demonstration:** Two trial areas will be designated by the Engineer to allow the Contractor to demonstrate that the equipment, personnel, and methods of operation can meet the requirements of this specification. The demonstration shall follow any roto-milling permitted by this specification. No separate or additional payment will be made for this demonstration.

The first trial area will consist of approximately 30 square feet (9 m<sup>2</sup>) of sound concrete. The hydrodemolisher shall be calibrated to remove sound concrete to the depth specified in the contract documents without damaging the underlying sound concrete. After removing the sound concrete in the first trial area, the hydrodemolisher shall be moved to the second trial area. This area will consist of deteriorated or defective concrete. This trial will determine whether this unsound concrete will be completely removed with the above calibration.

If the equipment is deemed inadequate for use, the Contractor shall obtain another hydrodemolisher for a subsequent demonstration. When satisfactory results are obtained, production removal may proceed. No adjustment in the completion date of the project will be considered due to delays in obtaining suitable equipment.

If concrete is not being adequately removed during production work, recalibration of the equipment will be required.

**679.2.3.2 - Blastcleaning Equipment:** Blastcleaning Equipment shall be capable of removing rust from reinforcing bars, laitance, and small chips of partially loosened concrete. Certain qualities of rust are not necessary to be removed (refer to Section 679.3.3).

**679.2.3.3 - Proportioning and Mixing Equipment:** Shall consist of the following:

**679.2.3.3.1 - Latex Modified Concrete:** Self-contained, continuous mixing and proportioning mobile units shall be used. A minimum of two units shall be supplied. The requirements of Sections 679.2.3.4 and 679.2.3.5 shall apply.

**679.2.3.3.2 - Microsilica Concrete:** An approved concrete batch plant, mobile mixer or truck mixer shall supply all concrete. The requirements of Section 601 of the Specifications shall apply, except as modified herein.

When microsilica densified powder is used, the densified powder shall be weighed using an approved cement scale or supplied in bags, the weight of each bag shall be clearly marked on the bag. The densified powder shall be last in the weighing sequence and the tolerance for each material draw weight shall be based upon the total weight of cement plus densified powder. Batching tolerance for the cement plus densified powder shall be 0.5%.

When microsilica slurry is used, the slurry shall be added prior to the initiation of the batching sequence using calibrated proportioning equipment approved by the Engineer. Batching tolerance of the slurry shall be 2%.

**679.2.3.4 - Mobile Mixer Units:** Each unit shall be self-propelled and shall be capable of carrying sufficient unmixed material to produce on site, no less than 6 cubic yards (4.5 cubic meters) of specialized concrete.

The Engineer will inspect each unit. A unit not functioning in a manner the Engineer considers acceptable shall be repaired. If repair is impractical, the unit shall be replaced. All costs associated with delays attributable to mobile mixer replacement shall be borne by the Contractor. No extension of time, for the purpose of replacing unacceptable mixers, will be granted. Conditions which will automatically designate a unit unacceptable are: hydrated cement deposits; broken, bent, loose or scalloped mixing paddles; mixing paddles worn 20% in any dimension; mixing paddles heavily caked with mortar; and admixture or water delivery system out of tolerance.

Proportioning devices shall deliver the materials within the following tolerances:

Coarse Aggregate	2%
Fine Aggregate	2%
Cement + fly ash	0% to 4 %
Water	2%
Cement + microsilica powder	0.5%
Microsilica Slurry	2%
Latex Admixture	1%
Other Admixtures	3%

The unit shall be capable of positive measurement of cement being introduced into the mix.

There shall be positive control of the flow of water into the mixing chamber. Water flow shall be indicated by a flowmeter and readily adjustable to provide for minor variations in aggregate moisture. The system shall be equipped with a bypass valve, or hose, for determining proportioning accurately. Also, there shall be a positive control of the flow of admixture into the mixing chamber. The admixture discharge pipe shall be readily accessible for determining proportioning accuracy.

The units shall be capable of being calibrated to automatically proportion and blend all components of indicated composition on a continuous or intermittent basis as required by the finishing operation, and shall discharge mixed material through a conventional chute directly in front of the finishing machine.

A sufficient number of self-propelled mixers shall be available at the job site to insure that not more than 30 minutes shall elapse between the placement of batches.

**679.2.3.5 - Mobile Mixer Unit Testing:** The units shall be calibrated by the Contractor to accurately proportion the approved mix design prior to placing the mix. The Engineer may require recalibration of any mixer as deemed necessary. Yield tests shall be performed by the Contractor for each mixer for each day's operation and when there appears to be a change in the mix. Certification of



the calibration by an approved testing authority will be accepted as evidence of this accuracy if the yield is shown to be true within a tolerance of 1.0% according to the following test:

With the cement yard set on zero and all controls set for the approved design mix, activate the mixer and discharge mixed material into a 0.25 cubic yard (meter) container 1 yard (meter) square by 9 inches (250 mm) tall. When the container is level-struck full, making provision for settling the material into all corners, the cement yard shall show the discharge for a 0.25 cubic yard (meter) pour within the tolerance specified (refer to 679.2.3.4). No calibration shall be performed while it is raining.

**679.2.3.6 - Placing and Finishing Equipment:** This shall include adequate hand tools for the placement of plastic concrete and for working down to approximately the correct level for the auger strike-off. A self-propelled finishing machine will be required to place and finish all concrete, except in areas inaccessible to the machine.

The finishing machine shall be capable of forward and reverse motion under positive control. Provisions shall be made for raising the screeds to clear the screeded surface, if traveling in reverse.

The machine shall be capable of placing full width, in one operation, the pours shown in the plans. The finishing machine shall be equipped with a vibrating device to consolidate the concrete, a power driven strike-off auger, a power driven finishing roller, and a pan float. The vibrating device shall vibrate at a frequency between 50 Hz and 115 Hz. A sufficient number of suitable portable lightweight or wheeled work bridges shall be required and used behind the finishing operation for touch-up work, surface texturing and curing cover placement.

Approved manual type screeds, metal plates equipped with electric vibrators, or hand held vibrators shall be used to consolidate and finish small inaccessible areas and slab reconstruction concrete.

Supporting rails shall be required. Rails may be two inch by 2 in. (50 mm) perforated steel bar stock, 2 in. (50 mm) pipe rail, or approved equal. They shall exhibit no bends or kinks. Rail supports shall be fully adjustable (not shimmed) to obtain the correct profile. Rail supports are subject to the requirements of 679.3.7.2.

When placing concrete adjacent to a previously completed pour, the side of the finishing machine adjacent to the completed pour shall be equipped to travel on the completed lane on rail supports only.

The placing and finishing equipment shall be designed so that the elapsed time between depositing concrete and final finishing shall not exceed 10 minutes.

**679.2.3.7 - Recording Thermometer:** The Contractor shall supply a continuous recording thermometer capable of recording temperatures in the 30 - 100° F (2 - 30° C) range. It shall likewise provide a recording capability over a 24-hour continuous period, minimum. The Contractor shall provide any ancillary equipment, supplies and labor necessary for calibration of this equipment.

**679.2.3.8 - Compressors Or Water Flushing Equipment:** Equipment used for surface preparation shall be of such size and capacity to thoroughly remove all foreign material from the surface being prepared.

**679.2.3.9 - Saw Cutting Equipment:** Only multi-bladed saw cutting equipment, using circular saw blades, will be permitted for final deck finish operations. The Engineer may allow the use of single blade circular saw equipment only where such equipment is necessary to complete the work as required.

**679.2.3.10 - Fogging Equipment:** Fogging equipment shall be available for use in accordance with these specifications. The fogging nozzles shall produce an atomized mist. Fogging nozzles shall incorporate compressed air to create the mist. Hand held or hand operated equipment shall be permitted when the Contractor has demonstrated that his operator has been trained in its use.

### **679.3 - CONSTRUCTION METHODS:**

**679.3.1 - Removal of Existing Deck Surface:** Prior to concrete deck removal operations, asphaltic patches or bituminous overlays shall be removed by hydrodemolishing, roto-milling, or other approved methods. All debris from patch or overlay removal shall be legally disposed.

To facilitate hydrodemolishing, up to one half of the total depth of concrete to be removed may be removed using roto-milling machines. If the Contractor chooses to use roto-milling, he shall determine the depth to the top mat of reinforcing steel using methods acceptable to the Engineer. The roto-milling operation shall be conducted in a manner that does not damage the existing reinforcing mats. If in the judgement of the Engineer the reinforcing mat is being damaged the remainder of the deck removal shall be by hydrodemolishing.

One pass of the hydrodemolisher shall be made to remove all concrete within the limits shown and to the depth specified in the contract documents. Care shall be exercised to avoid removing sound concrete beyond the specified depth.

Following the first pass of concrete deck removal, the Contractor shall sound the deck using chain drags and outline remaining areas of delaminated and unsound concrete for removal subject to the approval of the Engineer. Aerosol spray paint for outlining shall be provided by the Contractor. Edges around these concrete removal areas shall be vertical or slightly undercut. A second pass of the hydrodemolisher shall be made to remove the above concrete.

During the second pass, lances may be substituted for the hydrodemolisher in areas inaccessible or otherwise inconvenient to hydrodemolishing. Chipping hammers will be permitted by the Engineer only in areas demonstrated by the Contractor to be inaccessible to the hydrodemolisher and lances. Chipping hammers shall weigh less than 30 pounds and only chisel bits shall be used. Chipping hammers heavier than the nominal 15-pound class shall not be used to remove concrete from beneath any reinforcing bar.

Debris shall be removed directly following any concrete removal operations. Removal of debris shall be accomplished by hand and vacuum methods. All debris shall become the property of the Contractor and shall be legally disposed. The Contractor shall exercise care to avoid damage to the remaining concrete or exposed reinforcement.

The Contractor shall provide for the collection and disposal of all runoff water generated by the removal process. The Contractor shall obtain all required

permits and shall comply with applicable local, state, and federal regulations concerning such water disposal. The Contractor shall make provision for the safe handling of runoff water insofar as it may constitute a physical hazard on the adjacent or underlying traveled roadway surface.

Water will not be allowed to enter storm sewers, bridge drainage, downspouts, fingerdams, or any other drainage area of the deck surface. The Contractor shall exercise care to protect existing berm slopes from scouring by water jets or runoff water.

The Contractor shall provide adequate lighting to allow for the safe conduct of night removal operations, and shall obtain the Engineer's approval for same, exercising care to avoid any hazardous glare in the direction of oncoming traffic.

When a bridge deck has an asphalt overlay, the stated depth of removal shall be measured from the bottom of the asphalt overlay.

When full depth removal is necessary, the forming shall be performed in accordance with Sections 104.3 and 109.4 of the Specifications.

**679.3.2 – Removal of Newly Placed Deck Surface:** The finished deck surface shall be shotblasted in preparation for a mechanically bonded surface. Shotblasting shall remove the upper surface of the deck to the satisfaction of the engineer. This may require approximately  $\frac{1}{8}$  in. to  $\frac{1}{4}$  in. (3 to 6 mm) of the concrete to be removed. In all cases the surface laitance shall be removed to provide a solid profile on which to bond the overlay.

**679.3.3 - Preparation of Surface:** Blastcleaning shall be performed to thoroughly clean all horizontal and vertical receiving surfaces. Surfaces, which will be in contact with the specialized concrete overlay, shall have laitance and partially loosened chips of concrete removed by blastcleaning, which shall produce a bright, clean appearance. The edge of previously placed pours shall be similarly treated to promote bond.

All reinforcing steel, or other steel, which is to be in contact with the new concrete, shall be cleaned of all grease, dirt, concrete mortar and injurious rust. Injurious rust is defined as all scale, loose rust deposits, or all rust not firmly bonded to steel. Rust and concrete deposits, which in the Engineer's opinion, cannot be removed by blastcleaning, will be considered firmly bonded and may remain. Any portion of a reinforcing bar judged by the Engineer to have any more than 50% section loss shall be replaced at no additional cost to the Division. A light coating of orange colored rust that forms on the reinforcing steel, after blastcleaning is not considered detrimental to bond and may remain unless the time limit that follows is exceeded, or if ordered to be removed by the Engineer.

All debris from the blastcleaning operation shall be removed. After removal, the exposed reinforcing steel shall be supported and tied. Rustproof chairs shall be provided. If a continuous length of 6 ft. (1.8 m) or more of reinforcing bar is exposed, the Engineer may require supports and positive tie-downs at a maximum spacing of 4 ft. (1.2 m). Positive tie-downs shall consist of anchors drilled into the structural slab and connected to the reinforcing bars. Replacement bars shall be spliced to existing bars using either minimum 30 bar diameter lap splices, approved mechanical connectors, or a welded splice as directed by the Engineer. Welded splices, if approved, shall be in accordance with ANSI/AWS Structural Welding Code - Reinforcing Steel D1.4. The Engineer shall

be allowed sufficient time to inspect the work after the supporting and tying of the reinforcing steel has been completed.

Blastcleaning operations may be commenced in an area after necessary concrete removal, per Section 679.3.1 or Section 679.3.2, as applicable, has been completed. If more than 48 hours elapse from the termination of any blastcleaning operation to slab wetting, blastcleaning shall be repeated per the Engineers direction regardless of the apparent condition of the receiving surfaces.

**679.3.4 - Structural Slab Wetting:** The structural slab surface and any other porous surface, which will be in contact with new concrete, shall be prewetted with water. All standing water in depressions or areas of concrete removal shall be blown out with oil-free compressed air. The surface shall be thoroughly wetted to a saturated condition and shall be visibly moist when placement begins.

**679.3.5 - Placement Preconditions:** Slab reconstruction concrete, or overlay concrete, shall be placed only after all of the following preconditions are satisfied:

The Contractor has submitted to the Engineer, in writing, the proposed sequence of operations, equipment, number of personnel, and category of personnel to be used during the concrete placement.

- a) All concrete removal operations in the placement area are complete and approved.
- b) Deck drains have been cleaned of all debris and plugged.
- c) Blastcleaning has been completed on an area large enough to require one working day for concrete overlay placement. In no case shall this be less than one span long.
- d) Any additional blastcleaning, if required, has been completed and approved on an area large enough to require one working day for concrete overlay placement. In no case shall this be less than one span long.
- e) Slab temperature and wetting requirements are met.

**679.3.6 - Placing, Finishing and Curing Slab Reconstruction Concrete:** Slab reconstruction concrete shall be placed separately from overlay concrete except when both of the following conditions are, in the opinion of the Engineer, present:

- a) Areas of exposed reinforcing steel do not exceed 5% of the total slab area ready to be overlaid.
- b) Individual areas of exposed reinforcing shall not exceed 25 square feet (7.5 m) in area.

When these two conditions are present, slab reconstruction concrete may be placed integrally with overlay concrete.

The Contractor has the following choices of concrete placed as slab reconstruction concrete:

Overlay Type	Slab Reconstruction Concrete
Latex Modified	Latex Modified or Class K
Microsilica	Microsilica or Class K

Slab reconstruction concrete placed integrally with overlay shall match the Specialized Concrete Overlay.

Bonding grout shall be placed against all vertical surfaces receiving slab reconstruction concrete. The perimeter of these surfaces shall be nearly vertical or slightly undercut.

When Class K Concrete is used as reconstruction concrete, a self-contained mobile mixer meeting the requirements of 679.2.3.4 may be used to provide the concrete.

After blastcleaning is completed, the Contractor shall place slab reconstruction concrete in the locations where reinforcing bars have been exposed. The concrete shall be consolidated by internal vibration in accordance with Section 601.10.3 of the Specifications. It shall be finished to the level of the surrounding concrete, or to the middle of the reinforcing steel, whichever is higher. The surface of the new concrete shall be intentionally roughened to a raked finish. Placement of slab reconstruction concrete in accordance with this subsection shall not relieve the Contractor of the requirements to provide the minimum required thickness of overlay material.

**679.3.6.1 – Slab Reconstruction Concrete Curing Requirements:** Curing shall be accomplished in the following manner:

- a) Latex Modified Concrete. Curing shall be performed in accordance with 679.3.7.5.1.
- b) Microsilica and Class K Concrete. Curing shall be by means of quilted covers, or plastic coated fiber blankets. Quilted covers, if used, shall be kept wet for the entire curing period in accordance with 679.3.7.5.2. The wet curing period shall be 72 curing hours.

The use of membrane curing compounds shall not be allowed.

**679.3.6.2 – Removal of Slab Reconstruction Concrete Surface:** The slab reconstruction concrete surface shall be blastcleaned per the requirements of Section 679.3.3 prior to the placement of the overlay.

**679.3.7 - Placing and Finishing Specialized Concrete Overlay:**

**679.3.7.1 - General:** The following requirements shall apply for specialized concrete overlay placements:

- a) The normal overlay thickness shall be as shown on the plans. Under any circumstances, the overlay shall not be less than 1 ¼ inches (31 mm).
- b) The prepared surface of the structural slab shall be protected from contamination by any source.
- c) Concrete may be mixed at the point of deposition
- d) When placing Specialized Concrete Overlays on a newly placed deck, the deck concrete shall be a minimum of 28 days old. The sidewalks, parapets, or curbs shall be a minimum of 7 days old.

**679.3.7.2 - Finishing Equipment:** Supporting rails upon which the finishing machine travels shall be placed outside the area to be overlaid. Said rails shall be supported at spacings sufficient to prevent any deflections. If deflections occur, support spacings shall be reduced, or rails shall be replaced by more resistant rail material. Anchorage of supporting rails shall provide for horizontal and vertical stability. The Engineer may require positive anchorage. A hold-down device shot into the prepared surface, or new overlay, will not be permitted. Supporting rails shall not be treated with parting compounds or release agents to facilitate their removal.

Immediately prior to the beginning of overlay operations, the finishing machine shall be operated over the full length of the bridge segment to be overlaid. This test run shall be made with the screed adjustment set to its finishing position. While operating the finishing machine during the test, the screed rails shall be checked for deflection and the minimum overlay thickness confirmed. The clearance shall be checked with the use of 1 ¼ inches (27 mm) thick filler blocks attached to the bottom of the screed during the test run. All necessary corrections shall be made prior to any concrete placement.

**679.3.7.3 - Placement:** The following requirements shall apply during placement of the Specialized Concrete Overlay:

- a) No concrete shall be placed unless surface slab temperature requirements of 679.4.6 and 679.4.7 are met. So that the use of hand tools will be kept to a minimum, concrete shall be deposited as nearly as possible to its final position. Internal vibrators shall not be used for moving concrete into position.
- b) A pencil type vibrator shall be used along all construction joints to further consolidate the concrete to prevent voids.
- c) The new concrete shall be placed slightly above final grade. It shall then be struck-off, screeded, and finished to final grade.
- d) The finished surface, before texturing, shall be uniformly smooth, dense and even. Variations in pavement surface in excess of ⅛ in. (3 mm) above, or below, the proper finished elevation, or surface irregularities of more than ⅛ in. in 10 feet (3 mm in 3 m), will not be accepted.

- e) At transverse and longitudinal construction joints, the overlay placement shall be continued beyond the joint location a distance at least equal to the placement depth, and shall be allowed to stand free or shall be formed. After the overlay has cured, the concrete shall be sawed to a depth of  $\frac{3}{4}$  in.  $\pm \frac{1}{8}$  in. (19 mm  $\pm$  3 mm). The overlay material beyond the saw cut shall be chipped out to the level of the original prepared surface, or to the level of the reinforcing bars, whichever is higher. The chipped face of the construction joints shall not undercut the saw cut and shall have a slope of approximately 45°. Chipping hammers shall weigh less than 30 lb. (15 kg), and only chisel bits shall be used.
- f) A construction dam, or bulkhead, shall be installed in case of a delay in the placement operations exceeding 30 minutes duration. During any delays of 30 minutes or less, the placement shall be protected from drying with several layers of wet burlap. If the concrete placement is stopped, or delayed, for 90 minutes or more, further placement shall be discontinued and may be resumed only upon the approval of the Engineer. When a placement delay greater than 90 minutes occurs, the Contractor shall saw and seal a control joint in the overlay.
- g) Adequate precautions shall be taken to protect freshly placed concrete from rainfall. All placement operations shall stop when it starts to rain. The Engineer may order removal and replacement of material damaged by rainfall in accordance with 679.4.9.
- h) The addition of superficial water to the surface of the concrete to assist in finishing operations will not be permitted.

**679.3.7.4 - Surface Texturing:** The surface of the specialized concrete overlay shall be uniformly smooth, dense and even. The surface shall then be given a suitable texture with an approved burlap drag.

The Contractor shall texture in a transverse or longitudinal direction. Once begun, the direction of texturing shall not change. All texturing shall be performed prior to the beginning of curing operations. Only one pass of the drag over the finished area will be permitted. Texturing shall be in strict accordance with the time requirements of 679.3.7.5 for applying wet burlap.

If texturing is done in the transverse direction, the Contractor shall texture by hand methods as soon as practicable after finishing machine passage.

If texturing is done in the longitudinal direction, the burlap drag shall be a seamless strip and shall be attached to the work bridge such that the surface of the concrete is textured as soon as practicable after finishing machine passage. Small areas, inaccessible to the attached drag, may be textured by hand methods.

The finishing movement and resulting progress of the burlap drag shall be done in a manner so as to prevent ridges or gouges from forming in the concrete surface. The drag shall be weighted and the contact area changed as required to produce a texture acceptable to the Engineer. The drag shall be cleaned as required; to remove all hardened concrete particles.

Texture resulting from the drag shall stop within 1 ft. (300 mm) of curbs or parapets.

**679.3.7.5 - Curing:** It is the nature of specialized concrete overlay material to quickly form a plastic film at the surface upon drying. This film is to be protected from drying and cracking by prompt covering with wet burlap. Regardless of the type of concrete placed, the use of membrane curing compounds will not be allowed. Floor drains shall be immediately unplugged to permit the deck to drain.

The overlay surface shall be completely covered with clean, wet burlap. The burlap shall be thoroughly saturated over its entire area, but shall be drained of excess water before application. Burlap shall be lapped a minimum of 1 ft. (300 mm) and shall lay flat. Failure to apply wet burlap within 10 minutes after the concrete has been placed will be cause for rejection of the work as determined by the Engineer. The Engineer may extend time if the plastic film has not formed or the Contractor's fogging operation adequately protects the film.

**679.3.7.5.1 – Curing Latex Modified Concrete:** A layer of 4-mil (0.1 mm) thick white polyethylene film shall be placed over the burlap as soon as possible. The overlay shall then be wet cured for 48 curing hours. Care shall be exercised to ensure the burlap remains saturated for the 48-hour cure period. Plastic coated fiber blankets may be substituted for the polyethylene film, but shall not replace the initial wet burlap. The film (or fiber blankets) shall be anchored along all edges and internally to prevent the loss of moisture and from being displaced. After the wet cure, the polyethylene film and burlap shall be removed and the concrete shall be air-cured for 48 hours.

**679.3.7.5.2 – Curing Microsilica Concrete:** Care shall be exercised to ensure that the burlap is well drained. Burlap shall be continuously wet for a period of 96 curing hours by means of automatic intermittent sprinkling or a continuous wetting system.

#### **679.4 - CONSTRUCTION LIMITATIONS AND REQUIREMENTS:**

**679.4.1 - Stockpiling Aggregates:** All aggregates shall be stockpiled at the concrete mixing site or another location approved by the Engineer.

Stockpiles shall be completely covered and no additions to approved stockpiles are permitted.

The free moisture content of each aggregate type, at the time of batching, shall not exceed 7% of the saturated-surface dry weight of the fine or coarse aggregate or 8% total for both aggregates.

Fine and coarse aggregates, which are stored in piles or bins, shall be kept entirely separated.

**679.4.2 - Storage and Handling of Cement:** Suitable provisions shall be made to prevent the loss of cement during handling. Cement to be stored shall be kept in suitable weatherproof enclosures, which will protect the cement from dampness. Cement, which has developed lumps in storage, shall not be used.

**679.4.3 - Vehicular and Equipment Restrictions:** The operation of vehicles and equipment on or over, the structural slab area where concrete removal operations have been started is subject to the following restrictions:



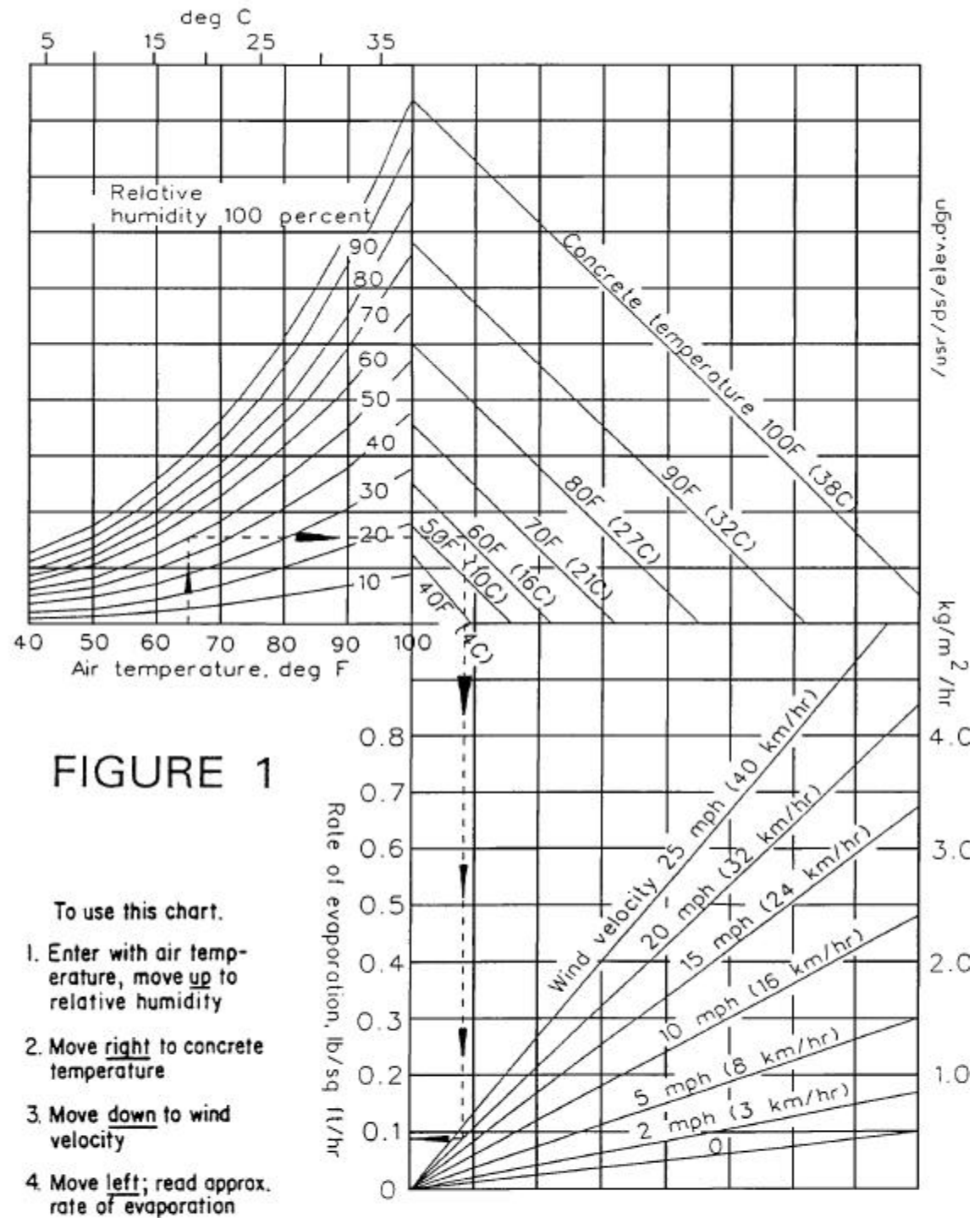
**679.4.3.1 – Vehicle Weight Limits:** Vehicular traffic is limited to necessary construction equipment. No vehicle or construction equipment weighing in excess of 7000 lb, (48 Mpa), shall be allowed to operate on, or over, any area of structural slab which exhibits unprotected, fully exposed reinforcing steel.

**679.4.3.2 – Runways:** Properly supported runways shall be provided where concrete transporting devices operate over exposed reinforcing steel and expansion devices.

**679.4.3.3 – Reinforcing Steel Protection:** Exposed reinforcing steel shall be protected from concrete transporting devices so that no debonding, loosening, bending, or breaking occurs. Reinforcement that is damaged by any of the Contractor's operations shall be removed and replaced to the satisfaction of the Engineer and at no additional cost to the Division.

**679.4.3.4 – Construction Loading Limitations During Curing:** No load shall be permitted on new concrete until the specified curing period(s) has been completed. No structural slab concrete removal work shall be performed on structural slab areas adjoining new concrete during the time the new concrete is curing.

**679.4.4 – Concrete Placement Limitations:** The plastic concrete, as discharged from the mobile mixer or delivery unit, shall be at a temperature of 50° F (10° C), minimum. If conditions are such that, in the opinion of the Engineer, this minimum may not be met, the provisions of Section 601.9.1 of the Specifications will apply. If the evaporation rate exceeds 0.10 lb./sq. ft. per hour (see Figure 1), the Contractor shall make provisions (i.e. wind breaks, fogging, etc.) to reduce the rate prior to placing concrete.



**679.4.5 – Concrete Pavement at Night:** If placement of any concrete is to be made at night, a plan which provides adequate lighting for the work area shall be submitted at least 14 days before concrete is placed for the Engineer's approval

**679.4.6 - Hot Weather Provisions:** The requirements of ACI 855, Hot Weather Concreting, shall apply except no concrete shall be placed when the ambient air temperature or deck surface temperature, after prewet, is above of 85° F (30° C). Concrete may be placed at an ambient air temperature of 85° F (30° C), if the deck temperature, after prewet, is no higher than 85° F of 85° F (30° C), and falling temperatures are predicted, and then only if the prediction indicates a temperature of under of 85° F (30° C) for the placement period. The time limitations for the placement of wet burlap, as required by 679.3.7.5, shall also apply.

**679.4.7 - Cold Weather Provisions:** No concrete shall be placed if the ambient air temperature or deck surface temperature, after prewet, is below 50° F (10° C), except as noted. Concrete may be placed at an ambient air temperature of 50° F (10° C) if the deck surface temperature, after prewet, is no less than 50° F (10° C) and rising air temperatures are predicted, and then only if the prediction indicates a temperature of over 50° F (10° C) for the eight hours immediately after placement. If air temperatures are such that the minimum temperature will not be met, the Contractor may place concrete if external heat is provided (refer to 679.4.8).

If the curing temperature drops below 45° F (7° C) during the curing period, then the surface shall be enclosed and external heat shall be provided in accordance with the provisions of 679.4.8. The time required for tenting will not be counted as curing time. Once external heat provisions are required, they shall remain on the surface until curing is complete, regardless of the ambient air temperature.

If curing temperature falls below 32° F (0° C), at any time during the curing period, the concrete will be rejected.

Continuous wetting shall be replaced by wetting at regular intervals if, in the opinion of the Engineer, expected air temperatures could result in freezing of run-off water.

**679.4.8 - External Heat Provisions:** The provisions of ACI 306, Cold Weather Concreting, and the following modifications shall apply:

- a) Temperature limits shall be maintained for 168 curing hours.
- b) If the concrete is latex modified concrete, then steam equipment shall not be used to supply external heat after the initial 48 curing hours.
- c) Enclosures for heat retention shall be properly vented to prevent surface disintegration from carbon dioxide gas.

- d) Continuous wetting will not be required, but the burlap shall be kept wet by wetting at regular intervals in a manner satisfactory to the Engineer for microsilica concrete.

**679.4.9 - Defective or Damaged Concrete:** After the overlay has been cured, the Contractor in the presence of the Engineer shall sound the deck in order to detect delaminated areas. All defective or damaged concrete, as determined by the Engineer, shall be repaired or replaced at no additional cost to the Division. Defects shall include but not be limited to delaminations, cracking, tearing, damage or other imperfections. The Contractor shall propose repair methods for approval by the Engineer. All concrete requiring removal and replacement, as determined by the Engineer, shall be removed by sawcutting the perimeter to a depth of  $\frac{3}{4}$  in.  $\pm$   $\frac{1}{8}$  in. (19 mm  $\pm$  3 mm). Damaged concrete shall then be chipped out to the level of the original prepared surface. The chipped face shall not undercut the sawcut and shall have a slope of approximately 45°. Chipping hammers shall weigh less than 30 pounds (15 kg), and only chisel bits shall be used. The prepared surface shall be blastcleaned prior to applying the overlay concrete.

#### **679.5 - FINAL BRIDGE DECK FINISH:**

**679.5.1 – Straightedge Test:** After defective or damaged concrete has been repaired and cured in accordance with 679.4.9 and before opening to traffic, the bridge deck shall be grooved perpendicular (or radial) to the centerline of the roadway. Prior to grooving, the entire deck shall be checked by the Contractor in the presence of the Engineer with an approved straightedge not less than 10 ft. (3 m) long. The straightedge shall be laid parallel to the centerline and half-lapped along lines approximately 5 feet (1.5 m) apart to cover the entire deck surface. Surface irregularities of more than  $\frac{1}{8}$  in. in 10 feet (3 mm in 3 m) shall be removed by grinding. Grinding shall leave a smooth surface within the straightedge tolerance.

**679.5.2 – Finished Deck Grooving:** After corrective grinding and before opening to traffic, grooves shall be cut into the concrete using a mechanical saw. These grooves shall be 0.10 inch (2.5 mm) wide and 0.25 inch (6 mm) deep. Groove spacing shall be 1.5 inches (37 mm) center to center. No later than one week prior to grooving operations, the Contractor shall provide the Engineer with two accurate, easily readable gauges with which to verify groove dimensions. Groove depth and spacing tolerances are limited to  $\pm 1/16$  inch (1.5 mm). Groove width tolerances are +0.02 inch (.5 mm) and -0.0 inch (0 mm). Grooves shall be cut continuously across the deck to within 1 ft. (300 mm) of gutter lines or drainage structures. Grooves shall also be continuous across the full width of the deck surface including construction joints. Grooves shall terminate within 1 in. (25 mm) of any exposed metal component or elastomeric concrete of an expansion joint. When the deck is skewed and the contractor is using gang blades to saw the grooves, the maximum distance (measured perpendicular to the centerline of the expansion joint) from the last groove termination in the pass to the expansion joint shall be 1 ft., 8 inches (200 mm). Radial grooving shall be performed in increments limited to 12 ft. (3.6 m) of bridge length.

#### **679.6 - METHOD OF MEASUREMENT:**

**679.6.1 – General:** The quantity of work performed for Specialized Concrete Overlay shall be measured in cubic yards (meters) of material complete in place and accepted. If the material is delivered in a mobile mixer, the pay quantity will be based on the printed ticket from the mixer. If the material is delivered from a central batch plant or truck mixer, the pay quantity will be based on the printed batch tickets as required in AASHTO M 157, Section 16, with adjustment for waste. The contractor and the engineer shall agree in advance on a method to determine the volume of the waste.

Test Slab will be measured on a lump sum basis complete in place. This shall include the complete execution of work required herein, regardless of the number of test slabs constructed. This item may be deleted at the discretion of the Engineer.

The quantity of work performed for Slab Reconstruction Concrete shall be measured in Cubic yards (meters) of material complete in place and accepted. Slab Reconstruction Concrete placed monolithic with the overlay shall be included in the overlay quantity. Concrete that is placed separately from the overlay shall be the volume as indicated by the batch quantity tickets for the ready-mix trucks or portable mixers adjusted for any material not incorporated into the work.

Removal of Existing Deck Surface shall be measured in square yards (square meters) of deck area that is to be overlaid. Existing concrete or asphalt removal shall be considered incidental to Removal of Existing Deck Surface as specified herein.

#### **679.7 – BASIS OF PAYMENT:**

The quantities, determined as provided above, will be paid for at the contract unit price bid for the items listed below. The price and payment shall be full compensation for all material removal and for furnishing and placing all the materials and doing all the work herein prescribed in an acceptable manner including all labor, tools, equipment, supplies and incidentals necessary to complete the work.

**679.7.1 – Rideability Price Adjustments:** Section 601.15.2 of the Standard Specifications shall apply to the finish requirements of the specialized concrete overly.

#### **679.8 - PAY ITEMS:**

ITEM	DESCRIPTION	UNIT
679002-*	SPECIALIZED CONCRETE OVERLAY	CUBIC YARD (METER)
679003-*	REMOVAL OF EXISTING DECK SURFACE	SQUARE YARD (METER)
679005-*	SLAB RECONSTRUCTION CONCRETE	CUBIC YARD (METER)
679006-*	TEST SLAB	LUMP SUM

\* Sequence number